Applying the CDIO model in provincial clinical practice training for TCM nursing professional Nurse

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Abstract

Background The growth of Chinese medicine nursing is gaining increasing attention as a result of the advancement of traditional medicine and the shifting public perceptions of health. Chinese medicine nursing talents are human resources that are essential to the field's development. A significant challenge to the training of TCM nursing talent is raising the standard of clinical practice instruction. In this study, to improve the quality of TCM nursing instruction and advance the field of TCM nursing, we established a clinical practice plan based on the CDIO (Conceptualization-Design-Implementation-Operation) concept and implemented it in the province's professional nurse training program.

Methods In our hospital，32 nurses who took part in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program from August to September 2023 were selected. The clinical practice stage of the training was conducted utilizing the CDIO model. After the training, the practical operation, the dialectical nursing ability and autonomous learning ability were assessed. We also assessed how satisfied they were with the training.

Results After the training, the clinical practice ability, dialectical nursing ability, and autonomous learning ability were all significantly higher than they were previously (all $P<0.05$). Nurses are more satisfied with the use of the CDIO model for

clinical practice training.

Conclusion CDIO model can improved clinical practice ability, enhanced their capacity to provide nursing care according to syndrome differentiation, stimulate the independent learning ability, and increased satisfaction with training. Furthermore, it offers novel ideas, methods, and strategies for upcoming clinical practice training.

Key words CDIO teaching mode, TCM nursing, clinical practice training, syndrome differentiation and care, autonomous learning capacity

INTRODUCTION

With the vigorous development of Chinese medicine and the transformation of people's health concepts, TCM nursing is increasingly emphasized by the state [1, 2]. According to the National Nursing Career Development Plan (2021 - 2025) [3], strengthening the training of TCM nursing professionals is necessary to promote the development of TCM nursing. Clinical practice training is a vital component in developing TCM nursing talents, and it’s a crucial stage in helping nursing staff improve their professional knowledge, master their professional abilities, and enhance their post-competence. Our hospital used the traditional training method in the early years of the Jiangsu Provincial TCM Nursing Professional Nurse Training Program, which was primarily focused on the teacher's instruction and demonstration of material, with the nurses accepting knowledge passively. While this model yields some benefits, it struggles to meet the needs to cultivate nurses' clinical practice competence. It also fails to encourage their subjective initiative, which is not conducive to their mastery and practical application of the specialized knowledge system [5]. Therefore, there is a dire need to find a solution to the problems of how to establish a training mode for clinical practice, pique students' and teachers' interest, and enhance the training effect.

The CDIO model [6] is an advanced engineering education concept developed by the Massachusetts Institute of Technology and other universities in the United States. It consists of four steps: conceive, design, implement, and operate. This model [7] is

based on the theory of “learning by doing”, emphasizes “student-centered”, advocates “project-based learning”, and encourages nursing students to learn knowledge in an active, hands on, and organically linked way among courses—all of which are consistent with the general rule of contemporary talent development. At present, the CDIO model has been widely used in the field of applied talent training [8]. Numerous studies [8-10] have demonstrated that the application of a CDIO concept-based nursing training is conducive to the nursing staff to acquire specialized nursing skills and related knowledge, comprehensively enhancing their comprehensive nursing capacity. Consequently, our hospital has implemented the CDIO model in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program. It promotes ongoing enhancements to the quality of instruction and provide a reference for in-hospital practical teaching.

MATERIALS AND METHODS

Participants

The research subjects comprised 32 nurses who were enrolled in the Jiangsu Provincial TCM Nursing Professional Nurse Training Program from August to September 2023. Inclusion Criteria: (1) Clinical registered nurse; (2) More than 5 years of experience in clinical nursing; (3) Possess some sort of level of technical TCM operation experience; (4) Hold a bachelor's degree or higher; (5) Informed consent and voluntary participation in this study. Exclusion Criteria: Those who dropped out of the training program. The 32 nurses were entirely female, aged 27 to 44 (34.22±4.61) years old. Each of them held a bachelor's degree. Table 1 provides more general details in depth.

TABLE 1　Characteristics of nurses in the training（*n*=32）

Items	Number of nurses (*n*)	Composition percentage (%)
Work seniority		
≤10	12	37.50
11~15	13	40.63

16~20	4	12.50
>20	3	9.38
Energy level		
N0	2	6.25
N1	0	0.00
N2	12	37.50
N3	16	50.00
N4	2	6.25
Professional titles		
senior nurse	8	25.00
supervisor nurse	19	59.38
co-chief superintendent nurse	5	15.63
Position		
nurse	20	62.50
nursing responsibility group leader	2	6.25
head nurse	8	25.00
department head nurse	2	6.25

Training methods

Form a training team

20 teachers, comprising 1 training manager, 8 head nurses, and 11 specialist nurses, accomplished the clinical practice training. The Nursing Department had recognized the 20 instructors as possessing requisite teaching qualifications, and these instructors have all served as clinical nurses for more than five years, holding the position of supervising nurse or above. The Nursing Department assembled training team members to become familiar with the teaching philosophies, methods, and curriculum design of the CDIO model prior to the start of clinical practice training.

Establishing clinical practice training schedule

The clinical practice training plan was set up with an emphasis on the prevalent diseases of key specialties and the TCM nursing technology in our hospital, in conjunction with the Nursing Department's syllabus. The scheme is outlined in Table 2. Clinical practice training lasted for four weeks. Teams of two to four nurses each were formed from those who took part in the training over the same time period, based on the clinical practice rotation table created by the Nursing Department. A team leader was chosen by each group to oversee the implementation of learning projects and manage the allocation of labor among group members. Prior to the training, the instructor and learner would receive training-related schedules from the nursing officer, and a 100% participation rate is necessary.

TABLE 2 The clinical practice training scheme based on the CDIO concept

Step	Training objectives	Training contents	Training methods
Conceive	1. Stimulate interest in learning 2. Cultivate a sense of self-directed learning	1. The instructor conceives clinical cases around common diseases and introduces learning tasks. 2. Each nurse independently searched the information to find the answers to the questions in the case.	Multimedia teaching Case-based teaching
Design	1. Grasp the key points and difficulties of the disease 2. Enhance teamwork skills	1. Teams work together to design the project. The team leader is in charge of allocating and coordinating the tasks for the project, guiding the group to address problems with the project, collect and organize pertinent data, and improve the nursing plan. 2. The teacher will provide appropriate guidance throughout the project design process.	Panel discussion Participatory teaching
Implement	1. Enhance clinical practice ability 2. Improve the core competency of the position	1. The team members carry out scenario simulation training in accordance with the planned and designed nursing plan. 2. Under the instructor's direction, nurses manage patients and engage in clinical operations.	video teaching Simulation training Practical operation Problem correction
Operate	Summarize and reflect on the deficiencies in clinical practice	1. Nurses reflect on their clinical work. 2. Instructors are led to reflect on their teaching.	Group interaction on WeChat Instructor evaluation

Implement the CDIO model in clinical practice training

Step 1, Project conceive : The instructor integrated theoretical expertise with practical

ability to conceive cases based on typical illness characteristics. The case's content addresses the crucial and challenging nursing care issues, encompassing all stages of the disease's development and the essential steps of the entire nursing process from the patient's admission to discharge.By using the case as a guide, the instructor presented the nurses with the learning task and assisted them in thinking about it. Through textbooks, literature, and other sources, the nurses constructed a theoretical and practical knowledge framework with regard to the condition, looked for the theoretical basis for solving case problems and came up with initial ideas for the case problem solutions.

Step 2, Project design : Groups worked together to carry out the project design. The leader of the team clarified the allocation of tasks in accordance with each member's personality traits and level of hands-on expertise, and organized the participants to analyze and discuss the cases together. Furthermore, they promptly communicated with the instructor when issues arose. On the basis of the conceptualization and group discussion, the instructor aided the nurses in designing two significant scenario simulation projects: “ syndrome differentiation ” and “ nursing care ”. The first project is “ syndrome differentiation ”, including the utilization of the four-diagnostic methods, eight-principle pattern identification, categorical identification in terms of causes, viscera syndrome differentiation and so on. The second project is “ nursing care ”, covering medication, diet, TCM nursing technology, psychological counseling and others centered around syndrome differentiation. During the design process for the project, the instructor in charge helped the group members sort through the pertinent knowledge points and discover the difficulties and crucial aspects of each module's knowledge. They also directed the nurses in incorporating the professional knowledge points into the project, as well as designing, producing, demonstrating, and modifying the project's specific plan of implementation.

Step 3, Project implement : The implementation of the program is divided into two sections: practical clinical practice and scenario-based simulation training. Participants in the team worked together to accomplish scenario simulation training.

Nurses carried out the skills exercise by role-playing activities as doctors, nurses, and patients in groups of two to four, which depends on the group division of labor and their individual features. At the end of the exercise, Participants in a group conducted self-evaluation and mutual evaluation, pointing out the deficiencies in the simulation training. The instructor offered feedback on the statements provided by the group, watched videos with the nurses for reinforcement of key operational procedures and knowledge points, fixed problems, and helped the nurses sort out, discuss, and make sense of the theoretical knowledge and practical operations of syndrome differentiation and care. Clinical practice means that the nurses were required to participate in patient management under the guidance of instructors and accomplish bedside practices. Each nurse has the responsibility of managing one to two patients, utilizing the knowledge acquired in the initial stages to independently perform syndrome differentiation along with offering care for various stages of disease progression. In order to accomplish the combination of knowledge points and clinical practice, the nurses took on self-evaluation once each day's work was finished and instructors provided advice.

Step 4, Project operate : Following the completion of the eight-hour clinical practice each day, the instructor in charge engaged in interactive question-and-answer sessions with the nurses via the WeChat group. This enabled the instructor to figure out each nurse's strengths and weaknesses in the process of skill operation, as well as to continuously improve the nurses' comprehension of the content that was being taught. At the end of the training, the teacher assessed the nurses and completed the the analysis of teaching quality and optimized the curriculum based on the nurses' the assessment results of nurses and their evaluation regarding the instruction.

Observation indicators

Operational assessment

Nurses selected two item at random from a list of operational assessments, which included moxibustion, auricular point sticking, cupping, scraping, massage,etc. The nurses were evaluated one-on-one by the evaluation team using the unified operation

assessment criteria. The full score is 100 points, with 80 points above the standard.

Dialectical nursing ability assessment

The day before the evaluation, the assessment team learn about nurse rostering and the circumstances of patients in charge. In addition, they picked a patient from among those under the care of nurses, and became acquainted with the patient's condition, nursing care, and other details.In accordance with the assessment requirements, the examiner graded, commented, and gave instructions to the nurses on the basis of their on-the-spot observations of the dialectical nursing scenario on the assessment day. Referring to the requirements of the Jiangsu Province clinical nurse work ability assessment criteria as well as prior studies [11], we designed our own "Record Chart Nurses' Ability to Syndrome Differentiation and Care". It consisted of four parts: general information, cross-sectional scenario assessment, clinical ability assessment, and evaluation of the assessment results. General information includes nurse and patient information. The 18 assessment contents that make up the cross-sectional scenario assessment include the following: assessing the patient upon admission, inspection diagnosis of TCM, auscultation and olfaction, inquiry of TCM, pulse feeling and palpation, distinguishing pathogenesis, determining disease location, analyzing syndrome types and more.The clinical competency assessment consists of six items that prehension ability of the four diagnostic contents, symptom analysis skills, TCM nursing diagnostic capacity, etc. The clinical competency assessment have a maximum score of 10 points, with six points awarded for passing. The difficulty coefficient of each assessment content is set at 0.9~1.1 with respect to the seriousness of the patient's condition and the complexity of the cross-section of the assessment reality. The nurses' dialectical nursing ability evaluation score was calculated by multiplying the clinical competency assessment score by the mean difficulty coefficient. A passing grade of 60 points is awarded for completing the assessment, which is dependent on a 100-point scoring system.

Self-directed learning ability evaluation scale

The self-directed learning ability evaluation scale developed by Xiao Shuqin [12] in 2008 was used. It consists of 34 items, including self-motivated belief, task analysis, self-monitoring and regulation, and self-evaluation. Each item was scored on a 5-point Likert scale, that is, from “completely inconsistent” to “completely consistent” , with 1 to 5 points. The total score ranged from 34 to 170 points, and the higher the score, the stronger the autonomous learning ability. The scale Cronbach’s alpha coefficient was 0.944. 64 questionnaires were given out prior to and following the training in this research, and 54 surveys were collected, yielding an 84.38% valid recovery rate.

Evaluation of training satisfaction

In the training satisfaction questionnaire, there were six dimensions covering teacher condition, training content, training form, training attitude, training atmosphere, and training effect. Each item was divided into fiver answers: extremely dissatisfied, dissatisfied, generally satisfied, somewhat satisfied, and satisfied. In this study, A total of 64 questionnaires were issued before and after the training, and 64 valid questionnaires were recovered, with an effective recovery rate of 100%.

Statistical Analysis

SPSS 25.0 statistical software was used to analyze the data. Enumeration data were expressed in frequency and percentage. The paired t-test was used to analyze measurement data that followed a normal distribution, which was presented as mean ± standard deviation ($\bar{x} \pm s$). Measurement data that did not follow a normal distribution were presented as median (M), quartile (P_{25}, P_{75}), and were subjected to a Wilcoxon rank sum-test analysis. A p-value < 0.05 was considered statistically significant.

RESULTS

The comparison of the operational intervention scores of nurses before and after the training is shown in Table 3.

After the training, the score of nurses' dialectical nursing ability was 87.88±6.64 points, which was significantly higher than that before (t = 17.531, P < 0.001), as shown in Table 4.

The self-learning ability evaluation results of 32 nurses showed that the total score of self-learning ability before the training was 124.50 ± 18.04 points, and the total score of self-learning ability after the training was 131.46±19.16 points, and the difference was statistically significant (t = 3.066, P < 0.05). The results are listed in Table 5.

The nurses were greater satisfied with the instruction since none of them expressed dissatisfaction with it, as shown in Table 6.

TABLE 3 Comparison of nurses' operational assessment scores before and after the training[*M*（P_{25},P_{75}）]

Time	Number of subjects（*n*）	Operation 1	Operation 2
Pre-training	32	90.00（82.75，90.00）	90.00（84.25，90.75）
Post-training	32	96.00（95.00，98.00）	96.00（95.25，98.00）
Z-value		4.952	4.949
P-value		0.000	0.000

TABLE 4 Comparison of nurses' dialectical nursing ability before and after the training（ $\bar{x}$±s）

Time	Number of subjects（*n*）	Dialectical nursing ability
Pre-training	32	68.78±8.92
Post-training	32	87.88±6.64
t-value		17.531
P-value		0.000

TABLE 5 Comparison of nurses' self-learning ability before and after the training（ $\bar{x}$±s）

Time	Number of subjects（*n*）	self-motivated belief	task analysis	self-monitoring and regulation	self-evaluation	total score
Pre-training	27	53.41±7.35	20.63±3.70	35.26±5.41	13.63±1.71	124.50±18.04
Post-training	27	54.85±7.53	22.30±4.13	38.19±6.15	14.93±2.35	131.46±19.16
t-value		1.253	3.047	2.731	3.040	3.066
P-value		0.221	0.005	0.011	0.005	0.005

TABLE 6 Satisfaction among nurses with clinical practice training in the CDIO model（*n*=32,%）

Items	Generally satisfied	somewhat satisfied	satisfied
Teacher condition	1（3.13）	3（9.38）	28（87.50）
Training content	1（3.13）	4（12.50）	27（84.38）
Training form	1（3.13）	6（18.75）	25（78.13）
Training attitude	0（0.00）	4（12.50）	28（87.50）
Training atmosphere	0（0.00）	5（15.63）	27（84.38）
Training effect	1（3.13）	3（9.38）	28（87.50）

DISCUSSION

The CDIO Model Aids in Enhancing Nurses' Clinical Practice Capabilities

Clinical nursing abilities are fundamental competencies for nurses that have a significant effect on patient satisfaction and care quality [13]. The cornerstone of TCM nursing is syndrome differentiation and care, which also serve as the fundamental principle that directs TCM clinical nursing [14]. As a result, it is essential to enhance nurses' operational proficiency and enhance their capacity of syndrome differentiation and care. Corresponding to the findings of preceding studies [4], the results of this research demonstrated that nurses' operation level and capacity for syndrome discrimination and care strengthened following training (P<0.05), revealing that the CDIO model can enhance nurses' capacity for clinical practice.

"Learning by doing, learning by doing" is an essential philosophy of the CDIO paradigm, since it may effectively integrate the development of hands-on abilities with the consolidation of specialized knowledge. Through self-reference, group discussions, and scenario simulation exercises, the nurses constantly sorted out the knowledge and TCM nursing operating processes in the initial phases of training. With the goal to master the essential knowledge and skills of syndrome differentiation and care for common diseases, nurses in the later stages of training engaged in patient management, accomplished the collection of medical histories, performed the four-diagnosis assessment, carried on dialectical analysis, offered TCM nursing operation provided wellness instruction, write Chinese medicine nursing records, etc. Nurses were enabled to further understand their own issues and enhance their level of operation and competence to conduct syndrome differentiation and care in a targeted manner by way of self-assessment, group mutual assessment, and teacher comments throughout the overall "design-implementation-operation" process. Furthermore, the current research discovered that The majority of nurses performed poorly on syndrome differentiation and care compared to their operational assessment scores, which indicated that even though they were proficient in operational processes, they were not sufficiently flexible to apply them on the basis of the patient's symptoms. In an effort to delve further into the deeper significance of TCM nursing techniques, it is proposed that future training concentrate on strengthening nurses' capacity to select appropriate TCM nursing operations on the basis of the syndrome types as well as etiology and pathogenesis. This is predicated on the notion that nurses have mastered the skill process.

The CDIO Model Promotes Nurses' Capacity for Self-directed Learning

A nurse's ability to perceive requirements, evaluate resources, select strategies, set objectives, and analyze effect is referred to as their autonomous learning capacity [15]. Fostering self-directed learning in nurses facilitates the consolidation and affirmation of their clinical role, the generation of positive professional values, and the formation of career resilience [16]. The results of this study indicate that there was a statistically

significant (P<0.05) increase in the overall score of nurses' autonomous learning ability adhering to training compared to prior to training. Thus, it appears that the CDIO model is beneficial in cultivating nurses' autonomous learning ability. This is in line with the result of Zhou Tong et al [17]. The CDIO model is a high-participation training mode that breaks through conventional clinical practice training methods. It transforms one-way indoctrination into two-way active learning, places the training object at the center, and puts special emphasis on the training object's active inquiry, discovery, and learning process. In order to spark interest in learning and boost the drive to learn, the instructor makes use of the case as the main example during the project conceive stage and encourages the nurses to use their leisure time to review what they have learned and conduct a preliminary analysis of the learning tasks. The establishment of scenario simulation exercises, group discussions, and remarks by teachers during the project design and implementation stage livened up the training environment and made this training more interactive and participative, enhancing the nurses' learning initiative. In the course of the program's implementation phase, the lead instructor provided daily guidance to nurses via the WeChat group, addressing their questions and highlighting their strengths and weaknesses. This encouraged the nurses to monitor, regulate, and evaluate themselves, leading to constant enhancements and an improvement in their capacity for learning on their own. It is advised that clinical instructors assume a strong "guiding" role in the upcoming training process, fully engage nurses in their own learning, help them make the shift from "have learned" to "manage to learn," realize knowledge internalization, and achieve the objective of a spiral increase in core competency.

The CDIO Model Has Received Excellent Feedback From Nurses

According to the study's findings, more than 95% of nurses were generally satisfied with the faculty, training substance, training format, training attitude, training atmosphere, and training effect. This suggested that nurses validated the training they receive. All of the clinical instructors in this study were specialist nurses with extensive teaching experiences who could apply theoretical knowledge to solve

clinical problems in a comprehensive and analytical manner. The instructional content was created in accordance with the Jiangsu Nursing Association's training outline, the hospital's specialty features, and the trainees' needs. It covered topics such as the four diagnostic methods, dialectical analysis, appropriate TCM nursing operations, TCM health education, and other areas that can effectively increase nurses' sense of access. The hands-on phase's training mode is more flexible, and the instructors help the nurses discuss and actively engage on their own by using techniques like case analysis, group discussions, simulation training, and on-site practical exercises. Additionally, they offered comments and responses to inquiries in an effort to enhance the learning environment and foster a greater feeling of engagement and experience between the instructors and the nurses. Through WeChat group interactions and in-person conversations, the instructors gained an understanding of the requirements of the nurses during the training period. They concentrated on feedback from nurses and humanistic care, thereby making the nurses feel a greater sense of belonging. In addition, in order to guarantee the effectiveness and quality of training, this program sets up a three-tiered management structure called "Nursing Department - Head of Nursing Unit - Tutor". This structure manages the major training nodes as well as the major factors influencing the quality of training.

CONCLUSION

In conclusion, nurses' operational level, their ability to syndrome differentiation and care, and their level of self-directed learning can all be improved by including the CDIO model into provincial clinical practice training for TCM nursing specialists. As well, nurses indicate a high degree of satisfaction with the training. However the use of the CDIO model in TCM nursing clinical practice training is still in its infancy. On the one hand, the training team's comprehensive competence must be increased, and the caliber of the cases used for instruction must be further enhanced. However, some students were briefly over-pressured and unwilling to embrace the new training model due to a lack of information collecting, a lack of knowledge regarding the fundamental theories of TCM, and a rigid way of thinking. This resulted in poor

learning efficiency and negative coping. In the future, it is advised to enhance the science, normalization, and accuracy of teacher training, harmonize the design standards for instructional cases, and progressively implement CDIO mode in accordance with training objectives.

AUTHOR CONTRIBUTIONS

Study design: Yanfei Cheng, Bei Wang, Jianning Li. Data collection: Yanfei Cheng, Jianning Li, Fengmei Wang, Xixia Zhang, Jian Zhou, Zhanghong Chen. Statistical analysis: Yanfei Cheng. Manuscript writing and editing: Yanfei Cheng, Bei Wang, Jianning Li. All authors gave approval for the final manuscript.

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